

Natural alarm clock

Terman M, Terman JS.

Controlled trial of naturalistic dawn simulation and negative air ionization for seasonal affective disorder. *Am J Psychiatry.* 2006 Dec;163(12):2126-33. Erratum in: *Am J Psychiatry.* 2007 Mar;164(3):529.

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OBJECTIVE: This trial assessed two novel nonpharmaceutical treatments for winter depression-naturalistic dawn simulation and high-density negative air ionization-delivered during the final hours of sleep. **METHOD:** The patients were 99 adults (77 women and 22 men) with the winter seasonal pattern of major depressive disorder (94 cases) and bipolar II disorder (five cases). Five parallel groups received 1) dawn simulation (0.0003-250 lux in the pattern of May 5 at 45 degrees north latitude); 2) a dawn light pulse (13 minutes, 250 lux, with an illuminant dose of 3.25×10^3 lux-minutes matched to the simulated dawn); 3) postawakening bright light (30 minutes, 10,000 lux); 4) negative air ionization at high flow rate (93 minutes, 4.5×10^{14} ions/second); or 5) ionization at low flow rate (93 minutes, 1.7×10^{11} ions/second). The symptoms were assessed over 3 weeks with the Structured Interview Guide for the Hamilton Depression Rating Scale-Seasonal Affective Disorder Version. **RESULTS:** Posttreatment improvement results were bright light, 57.1%; dawn simulation, 49.5%; dawn pulse, 42.7%; high-density ions, 47.9%; and low-density ions, 22.7% (significantly lower than the others). Contrary to the authors' hypothesis, analysis of variance failed to find superiority of dawn simulation to the dawn pulse or bright light. However, the dawn pulse led to a pattern of residual or exacerbated depressive symptoms similar to those seen in low-density ion nonresponders. **CONCLUSIONS:** Naturalistic dawn simulation and high-density ionization are active antidepressants that do not require the effort of postawakening bright light therapy. They can be considered candidate alternatives to bright light or medication.

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Dawn simulation and bright light in the treatment of SAD: a controlled study *Biol Psychiatry.* 2001 Aug 1;50(3):205-16.

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Background: Some small controlled studies have found that dawn simulation is effective in treating seasonal affective disorder (SAD). With a larger sample size and a longer duration of treatment, we compared dawn simulation with bright light therapy and a placebo condition in patients with SAD.

Method: Medication-free patients with SAD were randomly assigned to one of three conditions: bright light therapy (10,000 lux for 30 min, from 6:00 to 6:30), dawn simulation (1.5 hour dawn signal from 4:30 to 6:00 peaking at 250 lux), and a placebo condition, a dim red light (1.5 hour dawn signal from 4:30 am to 6:00 peaking at 0.5 lux.) Over the subsequent 6 weeks, the subjects were blindly rated by a psychiatrist using the Structured Interview Guide for the Hamilton Depression Rating-Seasonal Affective Disorder Version (SIGH-SAD). We modeled the profiles of the remissions ($SIGH-SAD \leq 8$) and response ($\geq 50\%$ decrease in SIGH-SAD) to treatment over time using Cox proportional hazards models.

Results: The sample consisted of 95 subjects who were randomized to the three conditions: bright light ($n = 33$), dawn simulation ($n = 31$) and placebo ($n = 31$). Dawn simulation was associated with greater remission ($p < .05$) and response ($p < .001$) rates compared to the placebo. Bright light did not differ significantly from the placebo. Dawn simulation was associated with greater remission ($p < .01$) and response ($p < .001$) rates compared to the bright light therapy. The mean daily hours of sunshine during the week before each visit were associated with a significant increase in likelihood of both remission ($p < .001$) and response ($p < .001$).

Conclusions: Dawn simulation was associated with greater remission and response rates compared to the placebo and compared to bright light therapy. The hours of sunshine during the week before each assessment were associated with a positive clinical response.

Thorn L, Hucklebridge F, Esgate A, Evans P, Clow A.

The effect of dawn simulation on the cortisol response to awakening in healthy participants. *Psychoneuroendocrinology*. 2004 Aug;29(7):925-30 Jun;18(6):520-6.

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Bright light exposure after awakening has been shown to elevate cortisol levels in healthy participants. The present study examined the effect of dawn simulation (a treatment for seasonal affective disorder) on the cortisol response to awakening and mood. Twelve healthy participants were supplied with a dawn simulator (The Natural Alarm Clock, Outside In, Cambridge Ltd), a bedside light that increases in intensity prior to awakening to approximately 250 lux over 30 mins when an audible alarm sounds. A counterbalanced study was performed on 4 consecutive normal weekdays, two of which were control days (no dawn simulation) and two experimental (dawn simulation). Saliva samples were taken immediately on awakening then at 15, 30 and 45 minutes post awakening on all 4 study-days. Total cortisol production during the first 45 mins after awakening was found to be significantly higher in the experimental condition than in the control condition. Participants also reported greater arousal in the experimental condition and there was a trend for an association between increased arousal and increased cortisol secretory activity under dawn simulation. This study provides supportive evidence for the role of light and the suprachiasmatic nucleus in the awakening cortisol response.

Leppämäki S, Meesters Y, Haukka J, Lönnqvist J, Partonen T

Effect of simulated dawn on quality of sleep--a community-based trial. *BMC Psychiatry*. 2003 Oct 27;3:14

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BACKGROUND: Morning light exposure administered as simulated dawn looks a promising method to treat Seasonal Affective Disorder, but it may moreover help with resetting the inaccurate organisation of body clock functions relative to sleep occurring in winter among people in general. Disturbances in sleep patterns are common and may compromise wellbeing even in the short term. Our hypothesis was that simulated dawn could improve the subjective quality of sleep during winter. **METHODS:** A community-based trial with 100 volunteer subjects provided with dawn simulators. Study period lasted for eight weeks, and subjects used the dawn simulators for two weeks at a time, each subject acting as his own control (ABAB-design). Main outcome measure was subjective quality of sleep recorded each morning with Groningen Sleep Quality Scale. **RESULTS:** 77 subjects completed the trial. Quality of sleep improved while subjects were using dawn simulator-devices ($p = 0.001$). The treatment became beneficial after six days' use of dawn simulator, but the effect did not last after the use was ceased. **CONCLUSION:** Dawn simulation may help to improve the subjective quality of sleep, but the benefits are modest. Further research is needed to verify these findings and to elucidate the mechanism by which dawn simulation acts on the sleep-wake pattern.

Avery DH, Kouri ME, Monaghan K, Bolte MA, Hellekson C, Eder D.

Is dawn simulation effective in ameliorating the difficulty awakening in seasonal affective disorder associated with hypersomnia? *J Affect Disord*. 2002 May;69(1-3):231-6.

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BACKGROUND: Patients with winter depression, (seasonal affective disorder, SAD) frequently complain of difficulty awakening in the morning. Dawn simulation has been found effective in treating SAD, but its effect on difficulty awakening has not been assessed. **METHODS:** Fifty medication-free patients with SAD associated with hypersomnia were randomized to receive either 1 week of dawn simulation (250 lux) or a dim (0.2-2 lux) placebo signal. The patients assessed their level of drowsiness upon awakening during the baseline week and during the treatment week using the Stanford sleepiness scale (SSS). A psychiatrist rated difficulty awakening after the baseline week and after the treatment week. **RESULTS:** Dawn simulation lowered both the difficulty awakening score ($P < 0.05$) and the SSS score ($P < 0.05$) compared to the placebo dawn signal. **LIMITATIONS:** Replication is necessary. No biological markers of circadian phase were measured. **CONCLUSIONS:** Compared to a placebo condition, dawn simulation appears effective in decreasing both prospectively assessed morning drowsiness and retrospectively assessed difficulty awakening. The symptom of difficulty awakening is consistent with the phase delay hypothesis of SAD. Assessment of difficulty awakening could prove useful in the evaluation of SAD.

Danilenko KV, Wirz-Justice A, Kräuchi K, Weber JM, Terman M.

The human circadian pacemaker can see by the dawn's early light. *J Biol Rhythms*. 2000 Oct;15(5):437-46.

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The authors' previous experiments have shown that dawn simulation at low light intensities can phase advance the circadian rhythm of melatonin in humans. The aim of this study was to compare the effect of repeated dawn signals on the phase position of circadian rhythms in healthy participants kept under controlled light conditions. Nine men participated in two 9-day laboratory sessions under an LD cycle 17.5:6.5 h, < 30:0 lux, receiving 6 consecutive daily dawn (average illuminance 155 lux) or control light (0.1 lux) signals from 0600 to 0730 h (crossover, random-order design). Two modified constant routine protocols before and after the light stimuli measured salivary melatonin (dim light melatonin onset DLMO_n and offset DLMO_{off}) and rectal temperature rhythms (midrange crossing time [MRCT]). Compared with initial values, participants significantly phase delayed after 6 days under control light conditions (at least -42 min DLMO_n, -54 min DLMO_{off}, -41 min MRCT) in spite of constant bedtimes. This delay was not observed with dawn signals (+10 min DLMO_n, +2 min DLMO_{off}, 0 min MRCT). Given that the endogenous circadian period of the human circadian pacemaker is slightly longer than 24 h, the findings suggest that a naturalistic dawn signal is sufficient to forestall this natural delay drift. Zeitgeber transduction and circadian system response are hypothesized to be tuned to the time-rate-of-change of naturalistic twilight signals.

Lingjaerde O, Førelund AR, Dankertsen J.

Dawn simulation vs. lightbox treatment in winter depression: a comparative study. *Acta Psychiatr Scand*. 1998 Jul;98(1):73-80.

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Dawn simulation, with gradually increasing bedside light in the morning, has shown promising results as an alternative to bright light treatment for winter depression. To compare these treatments, 61 out-patients with winter depression (20-70 years of age, 80% women) were randomized to receive either lightbox treatment with 1500-2500 lux white light for 2 h in the morning for 6 days on an out-patient basis (n=34), or dawn simulation treatment in their homes, with 60 or 90 min of light augmentation time to 100-300 lux, for 2 weeks (n=27). Patients' ratings of improvement on a visual analogue scale (correlating strongly with percentage reduction in an extended Montgomery-Asberg Depression Rating Scale (MADRS) score) at the end of treatment showed a mean of 40.0% (SD 27.7%) in the dawn simulation group and 57.4% (SD 29.9%) in the lightbox group (P=0.02). The majority of the patients in both groups maintained their improvement during a 9-week follow-up. Age, sex, current major depression or current use of antidepressants did not predict outcome in either group. No serious side-effects were observed.

Avery DH, Bolte MA, Wolfson JK, Kazaras AL.

Dawn simulation compared with a dim red signal in the treatment of winter depression. *Biol Psychiatry*. 1994 Aug 1;36(3):180-8. Links

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In a randomized, parallel design, 19 patients with winter depression were treated with either a week of a white 1.5-hr dawn simulation peaking at 250 lux or a week of a red, 1.5-hr dawn signal peaking at 2 lux. The subjects were told that they would receive either a white or red dawn reaching in intensity that would be dimmer than standard bright light treatment. At the end of both the baseline week and the treatment week subjects were blindly assessed with the Hamilton Rating Scale for Depression (HDRS). Analysis of covariance was used to compare the two dawn treatments. The white, 1.5-hr, 250 lux dawn simulation resulted in significantly ($p < 0.05$) lower HDRS scores compared to the red, 1.5-hr, 2 lux dawn. This is the second controlled study which indicates that dawn simulation is an effective treatment for winter depression.

Norden MJ, Avery DH.

A controlled study of dawn simulation in subsyndromal winter depression. Acta Psychiatr Scand. 1993 Jul;88(1):67-71. [Links](#)

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In a randomized, cross-over design, 16 subjects with recurrent autumn-winter symptoms but without major depression were treated with 4 days of dawn simulation consisting of a gradually increasing illuminance over 45 min peaking at 100 lx (slow dawn) and with 4 days of a light rapidly increasing over a 4 s period to 100 lx (rapid dawn). The slow dawn was significantly better than both baseline and the rapid dawn in improving subjective measures of energy, mood, social interest, productivity, quality of sleep and quality of awakening.

Avery DH, Bolte MA, Dager SR, Wilson LG, Weyer M, Cox GB, Dunner DL

Dawn simulation treatment of winter depression: a controlled study Am J Psychiatry. 1993 Jan;150(1):113-7. [Links](#)

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OBJECTIVE: This study sought to determine whether dawn simulation was superior to a shorter dimmer "placebo" dawn signal in treating winter depression. **METHOD:** In a randomized, parallel design, 22 patients with winter depression were treated with either 1 week of a 2-hour dawn simulation peaking at 250 lux or 1 week of a 30-minute dawn simulation peaking at 0.2 lux. The subjects were told that they would receive either a "gradual" dawn or a "rapid" dawn reaching an intensity that would be dimmer than standard bright light treatment. At the end of both the baseline week and the treatment week, subjects were assessed in a blind manner with the Hamilton Rating Scale for Depression. Analysis of covariance was used to compare the two dawn treatments. **RESULTS:** The 2-hour, 250-lux dawn simulation resulted in Hamilton depression scale scores that were significantly lower than scores after the 30-minute, 0.2-lux dawn simulation. **CONCLUSIONS:** This study indicates that dawn simulation is an effective treatment for winter depression.
